# GODDARD SPACE FLIGHT CENTER

Test Lab Report Summary

| | | | |
|---|---|---|---|
| *Report Number:* | Q10175DPA | *Project:* | SWIFT |
| *Part Type:* | Microcircuit | *System:* | BAT |
| *Part Number:* | TMP36GRT | *Initiated Date:* | 05/01/2001 |
| *Date Code:* | 9922 | *Report Date:* | 10/25/2001 |
| *Manufacturer:* | Analog Devices | *Investigator:* | C. Greenwell (562) |
| *Generic Number:* | TMP36 | *Requester:* | B. Meinhold (562) |
| *Purchase Spec:* | Commercial | *Approval / Date:* | |

Step 1: INCOMING INSPECTION

| Test | Quantity | Passed | Failed |
|---|---|---|---|
| External Visual | N/A | N/A | N/A |
| PIND Condition A | N/A | N/A | N/A |

Step 2: DESTRUCTIVE PHYSICAL ANALYSIS

Destructive Physical Analysis (DPA) was conducted per GSFC document "Plastic Encapsulated Microcircuit (PEM) Guidelines for Screening and Qualification for Space Applications", except that cross-section was done without dye penetrant and glassivation integrity testing was not performed.

17. SEM inspection revealed unacceptable metallization step coverage on SN's 03, 04 and 05 (see Figures 11 – 13). Some of the contacts were slightly misaligned which allowed for a quasi cross-sectional type view of these features. From these views it is estimated that the reduction from nominal metallization thickness is greater than 70%. This condition is cause for rejection per MIL-STD-883, Method 3.7.2. These devices have metal stripe widths of 2 µm.

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Summary of Analysis:

| *Serial Number* | 01 | 02 | 03 | 04 | 05 |
|---|---|---|---|---|---|
| *External Examination* | | | | | |
| 1. Markings - legibility and correctness | A | A | A | A | A |
| 2. Integrity of package seals | N/A | N/A | N/A | N/A | N/A |
| 3. Condition of external leads and plating | A | A | A | A | A |
| 4. Overall package condition | A | A | A | A | A |
| *Radiographic Examination* | | | | | |
| 5. Die bonding material and die alignment | A | A | A | A | A |
| 6. Package seal integrity | N/A | N/A | N/A | N/A | N/A |
| 7. Presence of foreign material | A | A | A | A | A |
| 8. Lead dress (if revealed) | A | A | A | A | A |
| *Acoustic Microscopy Inspection* | | | | | |
| 9. Condition of material interfaces (delaminations) | A | A | A | A | A |
| 10. Condition of molding material (voids, cracks) | A | A | A | A | A |
| *Internal Examination* (including cross-section) | | | | | |
| 11. Presence of foreign material | A | A | A | A | A |
| 12. Mechanical condition of die | A | A | A | A | A |
| 13. Wire bonds and lead dress | N/P | N/P | A | A | A |
| 14. Die bonding material | N/P | N/P | A | A | A |
| 15. Condition of die surface | N/P | N/P | A | A | A |
| 16. Condition of metallization | N/P | N/P | A | A | A |
| 17. SEM Examination | N/P | N/P | U* | U* | U* |
| *Bond Strength* | | | | | |
| 18. Strength | N/P | N/P | A | A | A |
| 19. Metallization adherence | N/P | N/P | A | A | A |
| *Die Bond Strength* | | | | | |
| 20. Strength | N/P | N/P | N/P | N/P | N/P |

SN's 01 and 02 subjected to cross-sectional examination.

(* = Refer to comments, A = acceptable, U = unacceptable, N/A = not applicable, N/P = not performed)

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Appended Photographs:

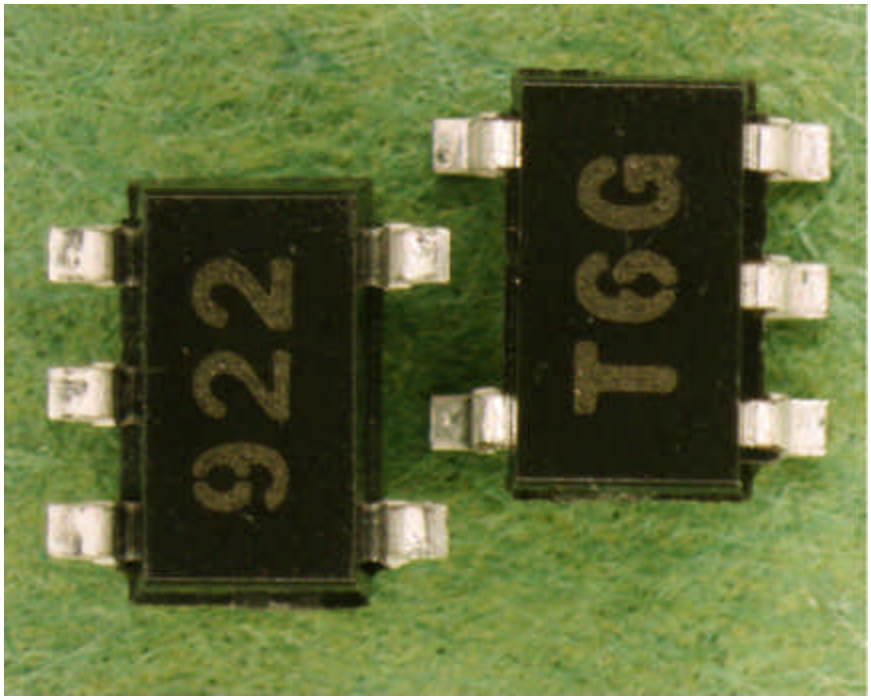


Figure 1. External top (right) and bottom views of TMP36GRT devices. 20X

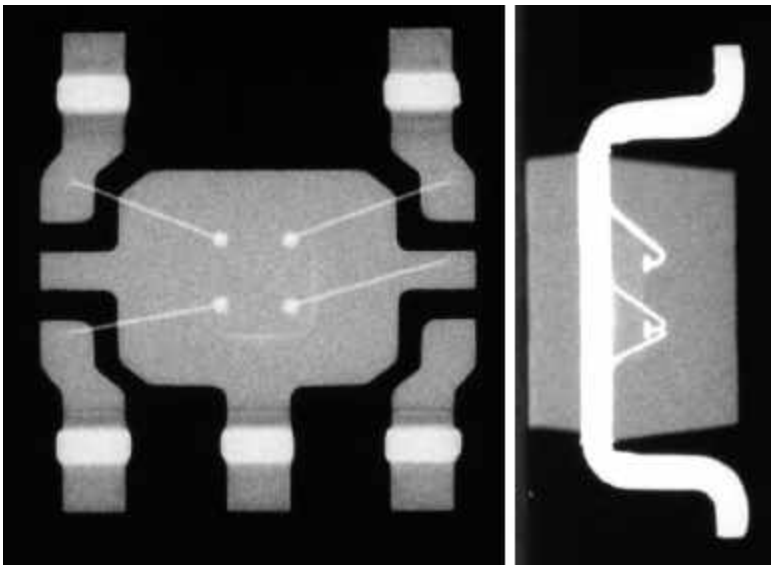

Figure 2. Top and side view radiographic images. 12X

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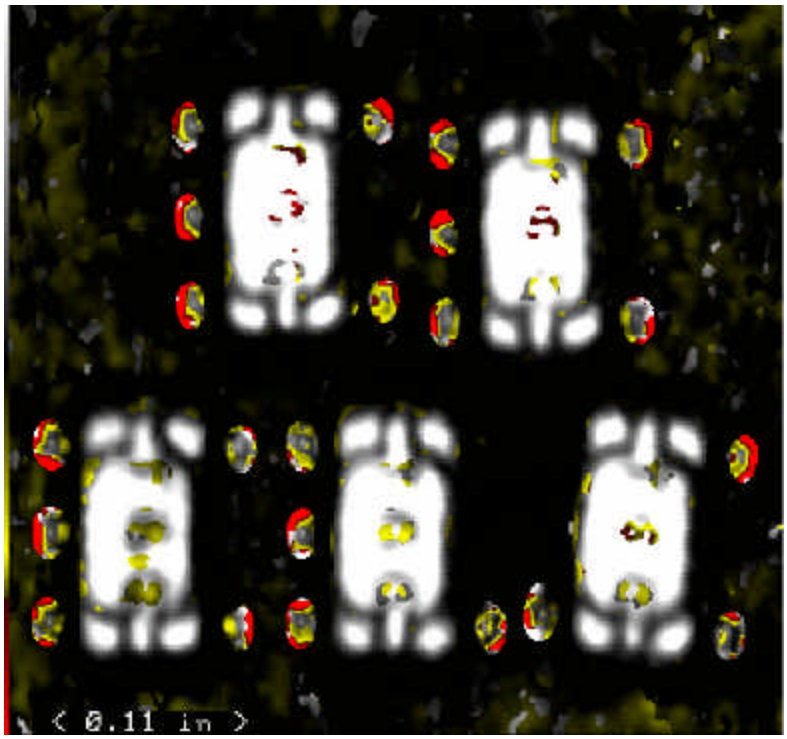


Figure 3. Top view C-SAM images of all five samples. The non-white areas of the die paddle are due to the part markings on the external surface.

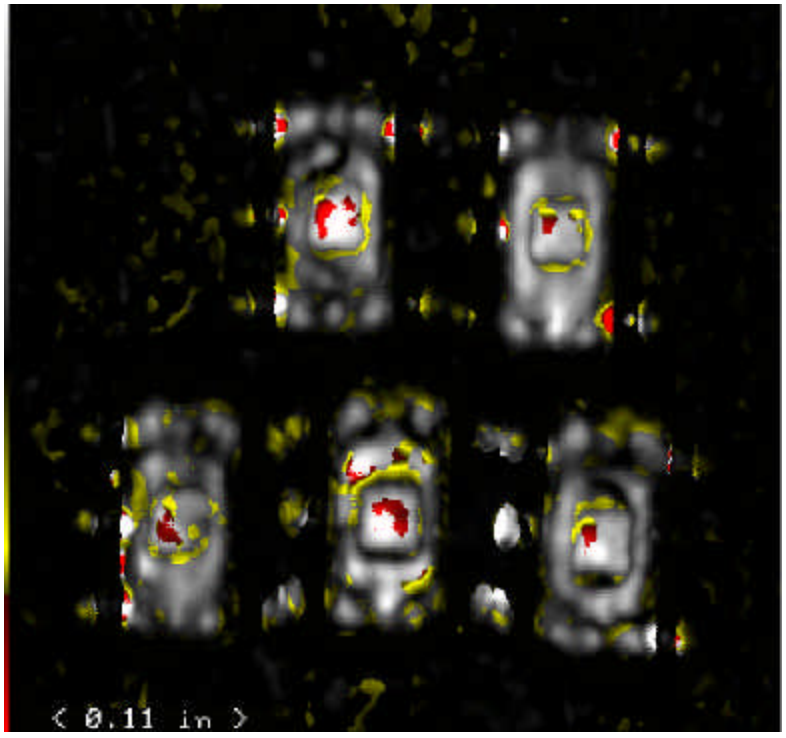


Figure 4. Bottom view C-SAM images.

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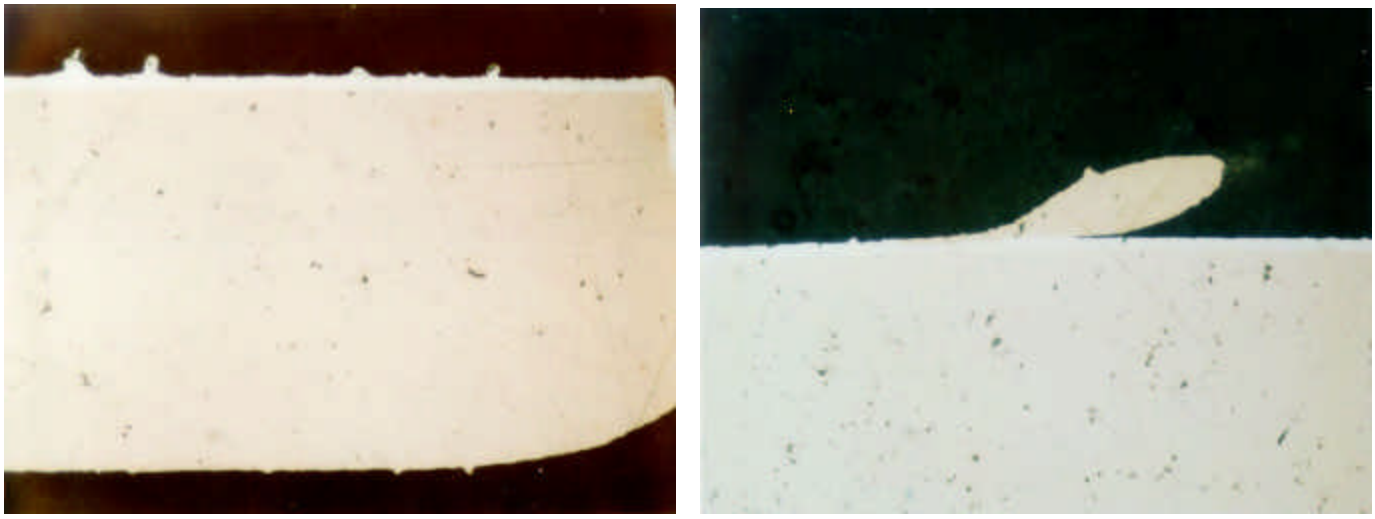

Figure 5. Cross-sectional images of SN's 1 (left) and 2. No delaminations were observed at three randomly sectioned planes within these samples. Both images - 400X

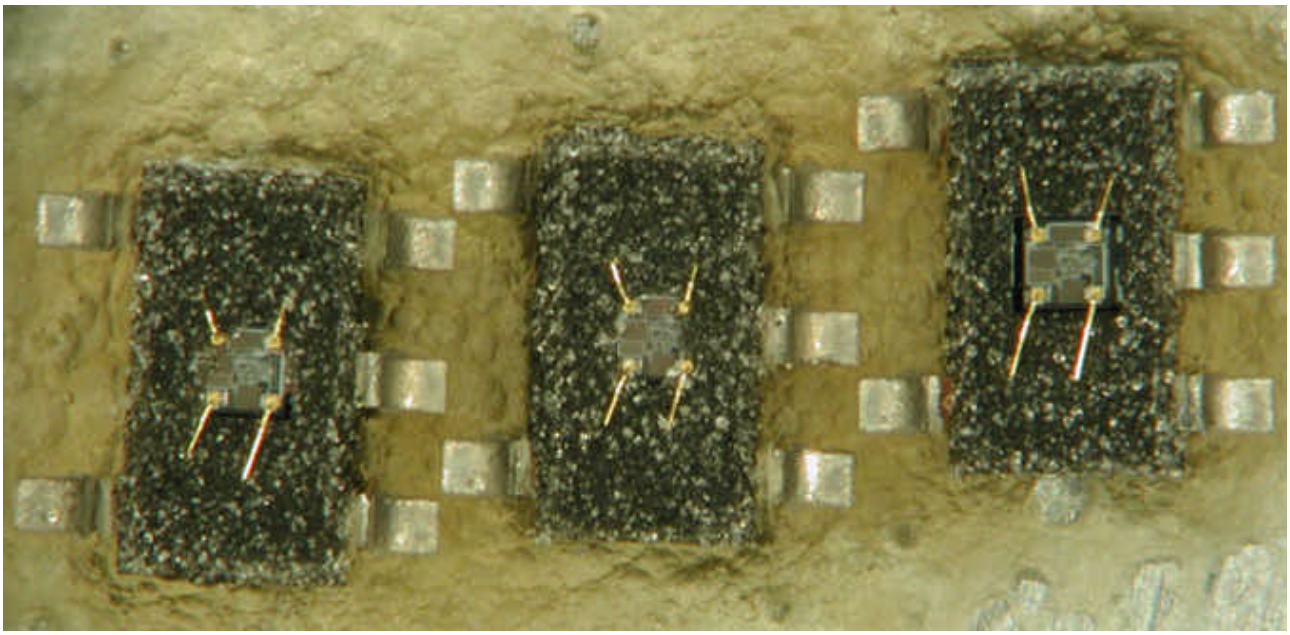

Figure 6. Three samples (SN's 03, 04 and 05; right to left) deprocessed and ready for internal examination. They are fixed with epoxy to an SEM mount.

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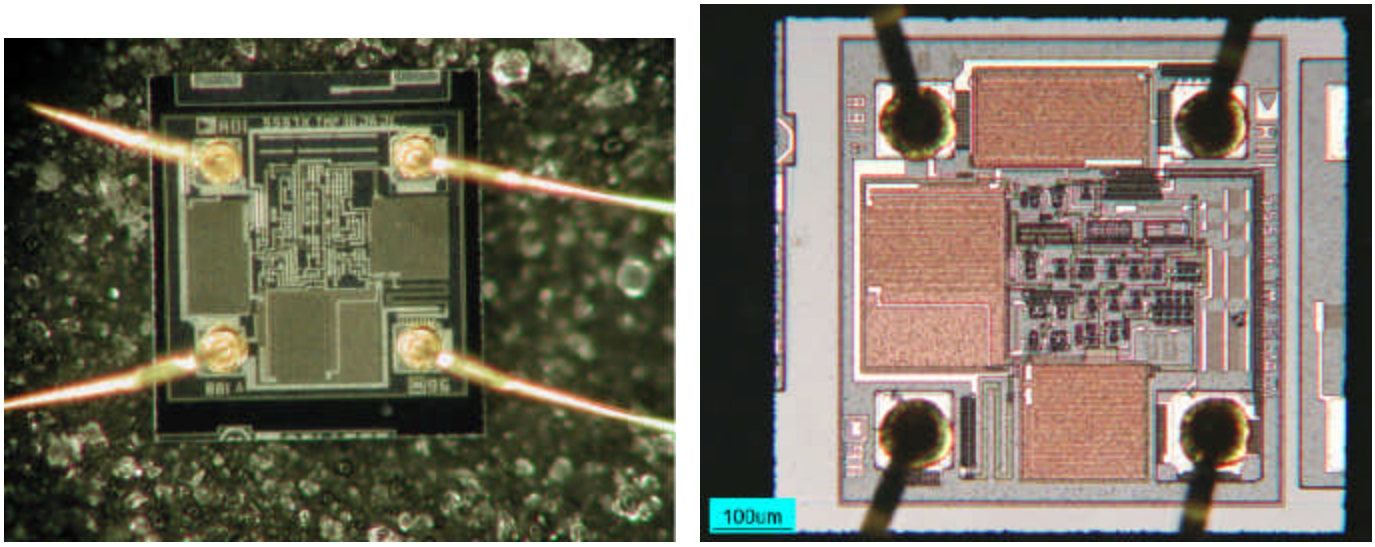


Figure 7. Optical macrograph images of SN 03.

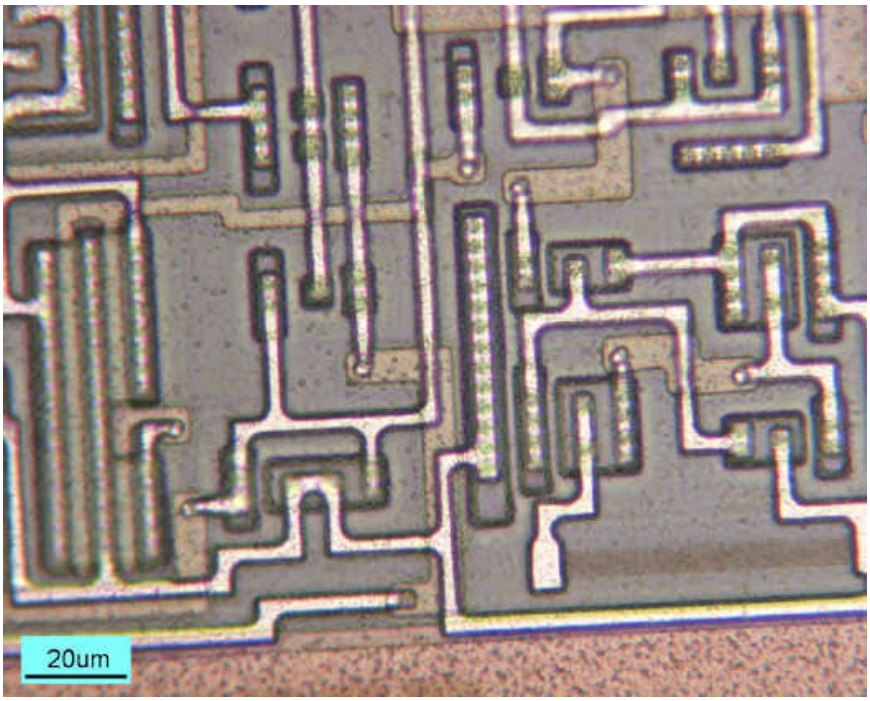


Figure 8. Optical micrograph image shows typical die features on SN 03.

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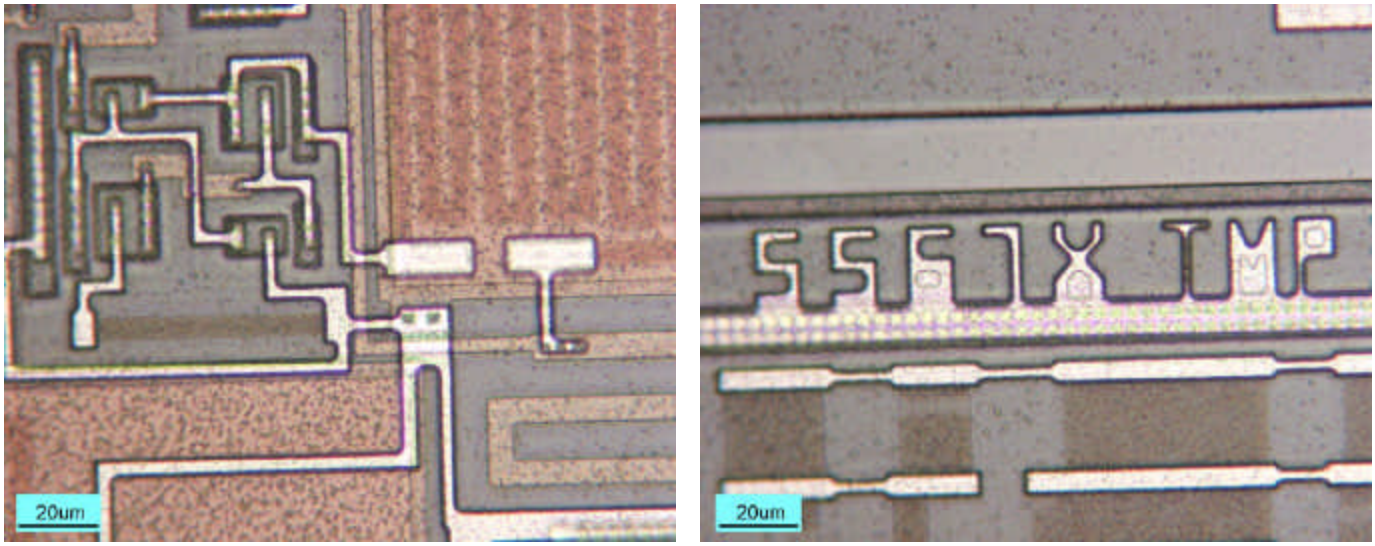


Figure 9. Optical images show features on SN 04.

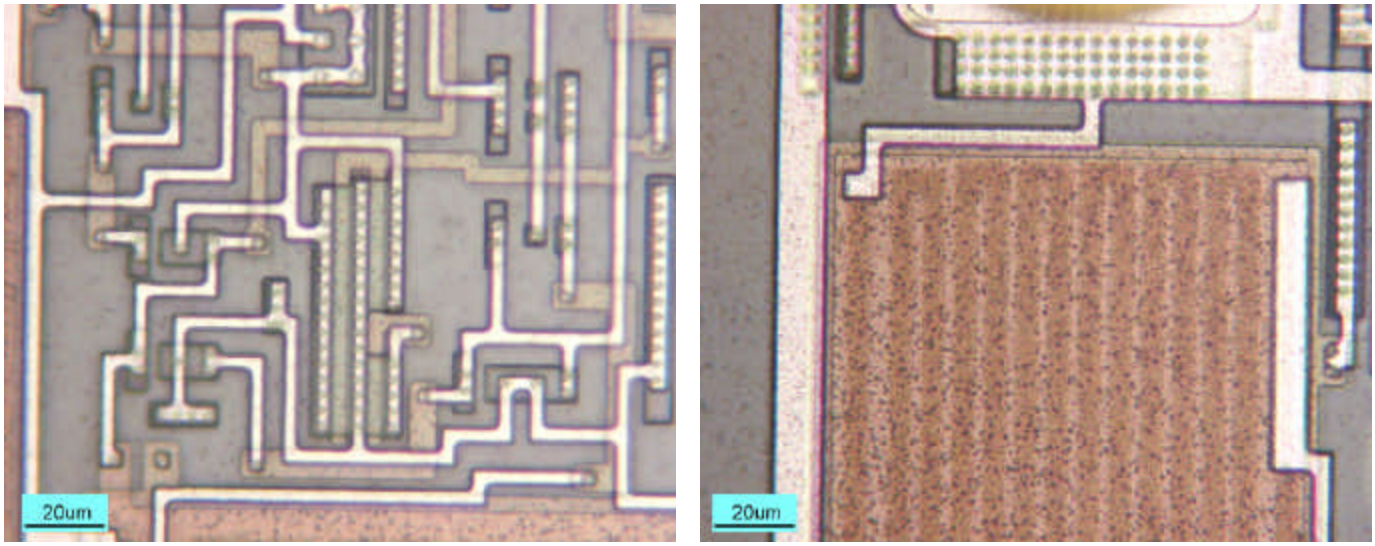


Figure 10. Optical images of features on SN 05.

These devices are difficult to inspect because of the relatively large topographical features on the dice and the grainy appearance of the passivation/glassivation layers.

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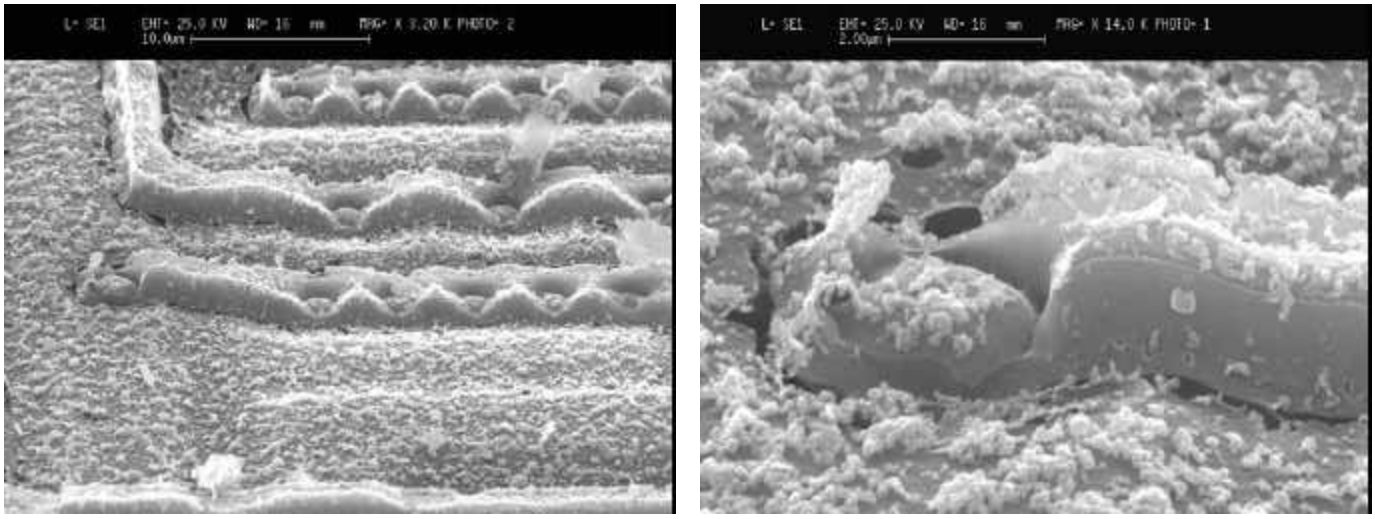

Figure 11. SEM micrograph images show rejectable step coverage features on SN 03 die. The right side image shows the metallization thickness reduced greater than 70% at this step. The left image shows the large topography variation that the metallization is deposited on.

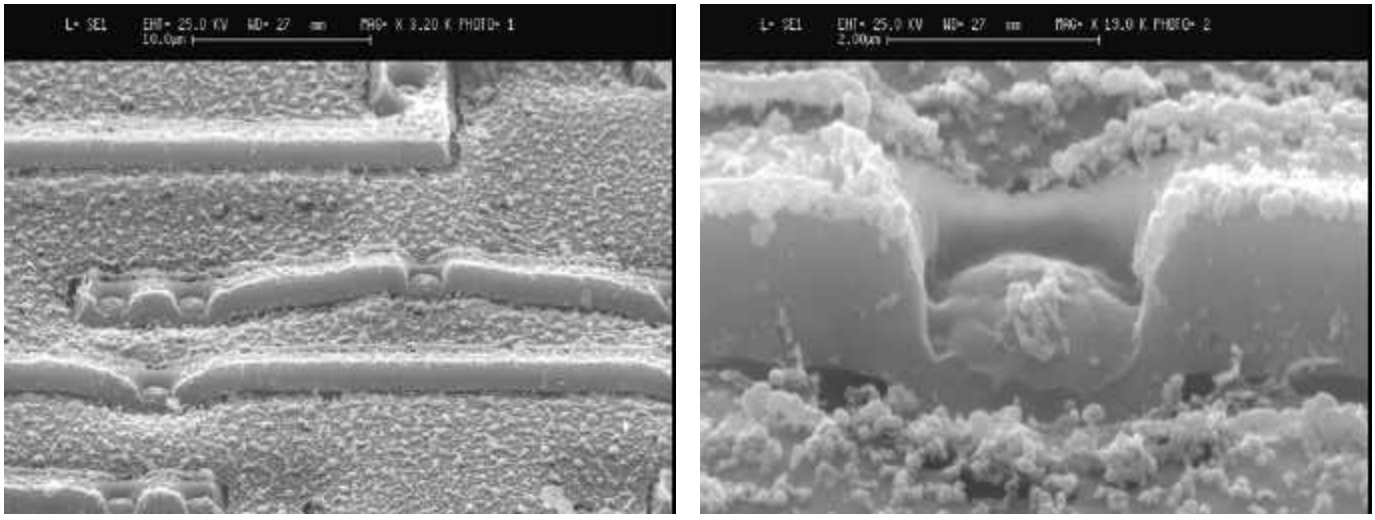

Figure 12. Similar features present on SN 04. Some of the debris present in these images is likely to be deprocessing artifact. It is not believed that the grainy surface feature is artifact; however, it is not known what this is.

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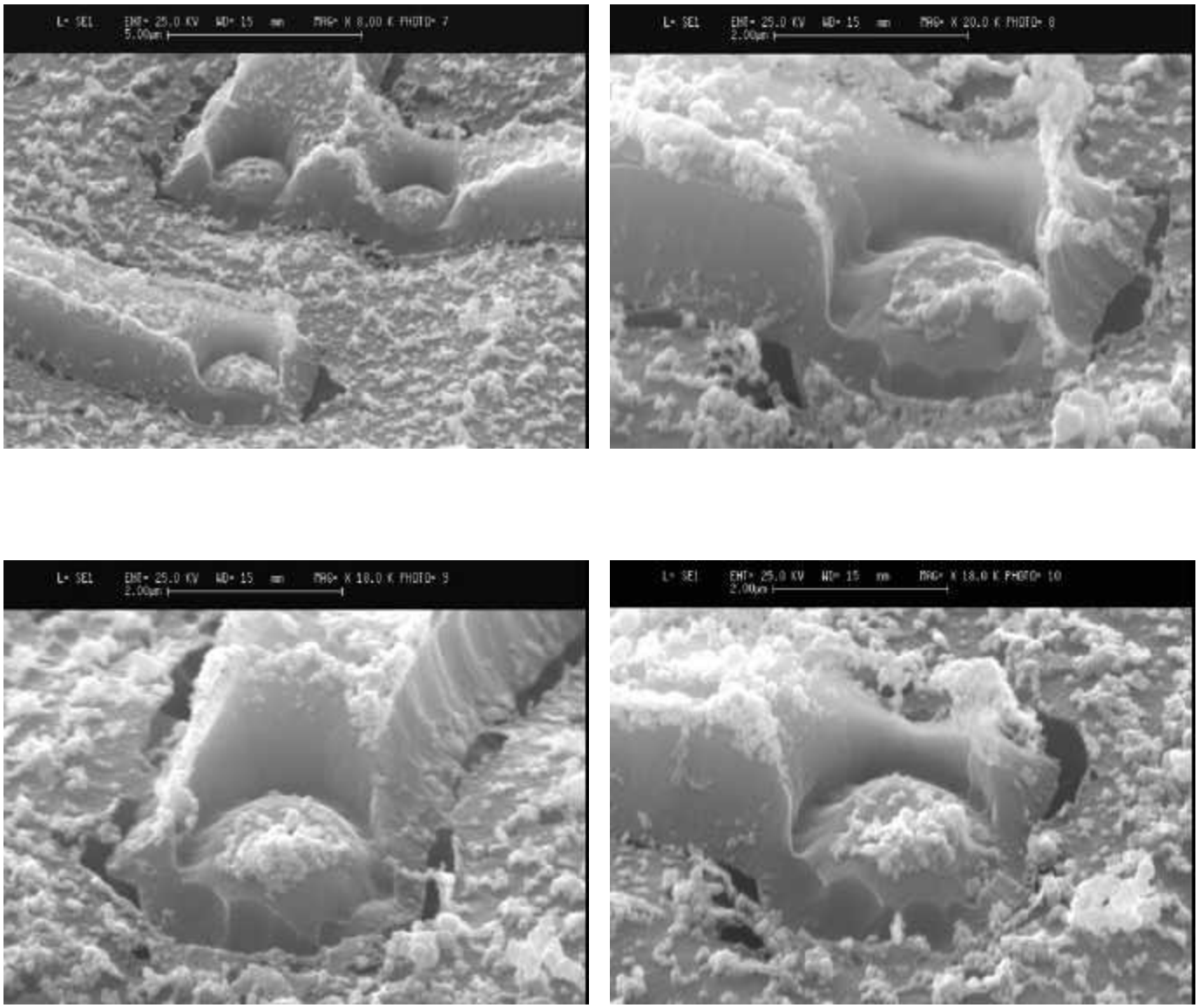

Figure 13. SEM images of similar features on SN 05.